

WHAT IS CLAIMED IS:

1. A hydrogen supply device for producing and supplying hydrogen to a hydrogen consumption device, comprising:

a low temperature fluid passage;

a high temperature fluid passage;

a heat exchange section having a rotary thermal storage through which the low and high temperature passages pass, the rotary thermal storage being driven to rotate;

a reforming material supply section for supplying at least a part of reforming material to the low temperature fluid passage on an upstream side of the heat exchange section;

a reforming section in which the reforming material is reformed to a reformed gas containing hydrogen after passing through the low temperature fluid passage; and

a combustion gas supply section for generating and supplying a combustion gas to the high temperature fluid passage,

wherein the rotary thermal storage rotates to move alternately between the low and high temperature fluid passages so that combustion heat of the combustion gas flowing in the high temperature fluid conduit is transferred to the reforming material flowing in the low temperature fluid conduit.

2. A hydrogen supply device according to claim 1, further comprising;

Pressurizing means for increasing pressure of the combustion gas flowing in the high temperature fluid passage.

3. A hydrogen supply device according to claim 2, further comprising;

a communicating passage through which the low temperature fluid passage communicates with the high temperature fluid passage,

wherein the pressurizing means is a gas compressor located at any one position among the low temperature fluid passage on a downstream side of the heat exchange section, the communicating passage and the high temperature fluid passage on an upstream side of the heat exchange section.

4. A hydrogen supply device according to claim 3, wherein the communicating passage comprises a reformed gas supply path through which the reformed gas containing hydrogen is supplied from the reforming section to the hydrogen consumption device and an off gas supply path through which off gas containing unreacted hydrogen that is not sufficiently consumed in the hydrogen consumption device is supplied from the hydrogen consumption device to the combustion gas supply section for producing the combustion gas and, further, wherein the gas compressor is located in the reformed gas supply path.

5. A hydrogen supply device according to claim 1, further comprising:

pressure adjusting means located at least at one of two passages consisting of the low temperature fluid passage

on an upstream side of the heat exchange section and the high temperature fluid passage on a downstream side of the heat exchange section.

6. A hydrogen supply device according to claim 5, wherein the pressure adjusting means is a pressure control valve that is operative to alter a fluid flow passage area.

7. A hydrogen supply device according to claim 6, further comprising:

first pressure detecting means for detecting pressure of the low temperature fluid passage in a vicinity of the rotary thermal storage;

second pressure detecting means for detecting pressure of the high temperature fluid passage in a vicinity of the rotary thermal storage; and

control means for controlling an opening degree of the pressure control valve according to the pressures of the low and high temperature fluid passages detected respectively by the first and second pressure detecting means.

8. A hydrogen supply device according to claim 7, wherein the control means controls the opening degree of the pressure control valve so that the pressure of the high temperature fluid passage is isobaric to or higher than the pressure of the low temperature fluid passage.

9. A hydrogen supply device according to claim 1, wherein the hydrogen consumption device is a fuel cell.

10. A hydrogen supply device according to claim 1, wherein the reforming material comprises a first reforming material containing at least water and second reforming material containing at least hydride compound, and, further wherein the reforming material supply section comprises a first reforming material supply section in which the first reforming material is supplied to the low temperature fluid passage on an upstream side of the heat exchange section and a second reforming material supply section in which the second reforming material is supplied to the low temperature fluid passage on a downstream side of the heat exchange section and mixed with the first reforming material to form the reforming material.

11. A hydrogen supply device according to claim 1, further comprising:

an off gas supply path through which off gas containing unreacted hydrogen that is not sufficiently consumed in the hydrogen consumption device is supplied from the hydrogen consumption device to the combustion gas supply section for producing the combustion gas.

12. A hydrogen supply device according to claim 1, further comprising:

a combustion fuel supply section provided in the

combustion gas supply section for supplying fuel to be combusted;
and

igniting means provided in the combustion gas supply section for igniting the fuel to produce the combustion gas.

13. A hydrogen supply device according to claim 1, further comprising:

an oxidation catalyst affixed to a surface of the rotary thermal storage that comes in contact with the combustion gas flowing in the high temperature fluid passage and reformed gas flowing in the low temperature fluid passage.

14. A hydrogen supply device according to claim 10, wherein the second reforming material supply section is provided with a mixing chamber in which the first and second reforming material are mixed.

15. A hydrogen supply device according to claim 1, wherein the rotary thermal storage is provided with a matrix having a plurality of through-holes extending axially and a housing in which the matrix is rotatably housed, each of opposite axial end of the housing having a first region communicating with the high temperature fluid passage and a second region communicating with the low temperature fluid passage so that the combustion gas flowing in the high temperature fluid passage passes through the through-holes whose opening ends face to the first region and the reforming material flowing in the low

temperature fluid passage passes through the through-holes whose opening ends face to the second region.

16. A hydrogen supply device according to claim 1, further comprising:

an actuation combustion chamber provided in the low temperature fluid passage on an upstream side of the heat exchange section, actuation fuel containing at least hydride compounds being supplied to the actuation combustion chamber; and

igniting means provided in the actuation combustion chamber for initiating flame combustion of the actuation fuel supplied to the actuation combustion chamber at a time of actuation of hydrogen supply device,

wherein combustion gas due to the flame combustion passes through the heat exchange section and the reforming section to the combustion gas supply section so that the heat exchange section and the reforming section are heated up more rapidly.

17. A hydrogen supply device according to claim 1, further comprising:

an actuation combustion chamber provided in the low temperature fluid passage between the heat exchange section and the reforming section, actuation fuel containing at least hydride compounds being supplied to the actuation combustion chamber; and

igniting means provided in the actuation combustion

chamber for initiating flame combustion of the actuation fuel supplied to the actuation combustion chamber at a time of actuation of hydrogen supply device,

wherein combustion gas due to the flame combustion passes through the reforming section to the combustion gas supply section so that the reforming section are heated up more rapidly.

18. A hydrogen supply device according to claim 16, wherein content of the actuation fuel is same to that of the reforming material for producing the reformed gas containing hydrogen.

19. A hydrogen supply device according to claim 17, wherein content of the actuation fuel is same to that of the reforming material for producing the reformed gas containing hydrogen.

20. A hydrogen supply device according to claim 1, further comprising:

an actuation combustion chamber provided in the low temperature fluid passage between the heat exchange section and the reforming section, the reforming fuel containing at least hydride compounds and air being supplied to the reforming material supply section and another air being supplied to the actuation combustion chamber; and

igniting means provided in the actuation combustion chamber for initiating flame combustion of the reforming

material at a time of actuation of hydrogen supply device,
wherein combustion gas due to the flame combustion
passes through the reforming section to the combustion gas supply
section so that the reforming section are heated up more rapidly.